ISSN 2816-8070

RESEARCH ARTICLE

AI-Enhanced Mentoring for Social Entrepreneurship: Catalyzing Regenerative Finance and Sustainability Transitions

Henry Efe Onomakpo Onomakpo*

Faculty of Economics and Business, Universitas Gadjah Mada, Indonesia

Abstract

Objectives: This research investigates the intersection of Artificial Intelligence (AI), Deep Tech, and social entrepreneurship (SE) in driving financial innovation for sustainability transitions within the banking, finance, and insurance sectors. It also examines the role and potential of mentoring, particularly AI-driven approaches, in guiding social entrepreneurs to develop and scale regenerative finance solutions and attract impact investment.

Methods: Employing a mixed-methods approach, a Systematic Literature Review (SLR) following PRISMA guidelines was combined with Bibliometric Analysis. A comprehensive search across major academic databases yielded 99 relevant peer-reviewed articles. Analysis identified publication trends, citation metrics, and key thematic connections.

Results: Findings demonstrate that AI and Deep Tech are powerful catalysts for SE in finance, enabling data-driven innovation, enhancing operational efficiency, and facilitating transformative instruments. Digital SE improves scalability. Bibliometric analysis confirmed social entrepreneurship centrality, linked to deep tech startups and social impact. Mentoring is critical for navigating complexities, strategic planning, and networks. AI-enhanced mentoring's specific potential is currently underexplored in the literature, but it shows significant promise.

Conclusions: AI and Deep Tech catalyze SE financial innovation for sustainability. Mentoring (human and AI-enhanced potential) is vital for SEs to leverage these technologies effectively, scale impact, and attract investment. Developing ecosystems, tailored AI-mentoring models, and robust impact metrics is crucial for a regenerative financial future. This study identifies critical gaps and provides a framework for future research for academics and practitioners.

Key Words: *Social entrepreneurship; Artificial intelligence; Deep tech; Mentoring; Regenerative finance; Sustainability transitions; Financial innovation.*

***Corresponding Author**: Henry Efe Onomakpo Onomakpo, Professor, Faculty of Economics and Business, Universitas Gadjah Mada, Indonesia; E-mail: henryonomakpo@gmail.com*

***Received Date**: April 5, 2025, **Accepted Date**: May 02, 2025, **Published Date**: May 19, 2025*

***Citation:** Onomakpo HEO. AI-Enhanced Mentoring for Social Entrepreneurship: Catalyzing Regenerative Finance and Sustainability Transitions. Int J Bank Fin Ins Tech. 2025;3(1):63-78.*

OPEN ACCESS

This open-access article is distributed under the terms of the Creative Commons Attribution Non-Commercial License (CC BY-NC) (http://creativecommons.org/licenses/by-nc/4.0/), which permits reuse, distribution and reproduction of the article, provided that the original work is properly cited, and the reuse is restricted to non-commercial purposes.

1. Introduction

The global imperative for sustainability transitions necessitates innovative financial and economic models that drive ecological regeneration and address climate change risks impacting the financial sector [1]. Traditional, efficiency-focused sustainability approaches are proving insufficient, requiring transformative changes driven by disruptive innovation. Social entrepreneurship (SE), offering market-based solutions to socio-environmental problems [2], presents a potent mechanism for achieving these transitions, including fostering novel financial instruments and inclusive economic models.

Artificial Intelligence (AI) and Deep Tech are revolutionizing various sectors, including banking, finance, and insurance technologies, and offer unprecedented potential to enhance social enterprise effectiveness within sustainability-focused financial innovation [3-5]. These technologies enable new financial instruments, risk assessment models, and inclusive financial technologies crucial for driving capital towards sustainable and regenerative initiatives within the banking and insurance landscape.

However, significant knowledge gaps persist in understanding how social enterprises can effectively leverage AI and Deep Tech to drive regenerative finance – financial models that actively enhance both ecological and economic systems – and in identifying support mechanisms to foster this innovation. Specifically, how social enterprises can effectively utilize AI and Deep Tech to develop and scale regenerative financial solutions remains underexplored.

While mentoring is recognized as crucial for entrepreneurial success [6], the specific role of AI-enhanced mentoring in fostering social entrepreneurship for regenerative finance innovation is yet to be examined within the current literature. Therefore, the central research problem is: How can AI-driven social entrepreneurship mentoring catalyze financial innovation for sustainability transitions and regenerative finance?

To address this problem and bridge the identified knowledge gaps, this research focuses on two key questions:

- How do Al and Deep Tech enhance social entrepreneurship's role in driving financial innovation for sustainability transitions within the banking, finance, and insurance sectors?
- What is the role of mentoring, particularly AI-driven mentoring, in effectively guiding social entrepreneurs to develop and scale regenerative finance innovations and attract impact investment?

This research employs a comprehensive literature review, synthesizing studies across social entrepreneurship, sustainable finance, financial innovation, and technology management to build a theoretical framework and inform future research directions in fostering AI-driven social enterprises that can reshape financial technologies for a regenerative and sustainable future. This study is a foundational review intended to map the existing scholarly landscape and identify critical areas for future empirical investigation.

2. Materials and Methods

This study employed a mixed-methods approach combining a systematic literature review (SLR) and bibliometric analysis. The SLR followed PRISMA guidelines [7] for rigorous and transparent methodology, while bibliometric analysis provided quantitative landscape mapping. The SLR methodology synthesized existing research on social entrepreneurship, AI, DeepTech, and sustainability transitions.

2.1. Data sources and search strategy

A comprehensive search was conducted in Scopus, Web of Science, and Dimensions databases, using combinations of keywords such as (social entrepreneurship or social enterprise) and (sustainable innovation or regenerative economy or sustainability transition) and (artificial intelligence or AI or deep tech). This initial search yielded 990 records. No additional relevant publications were found via grey literature searching.

2.1.1. Study selection and screening

Retrieved publications were screened in stages, adhering to PRISMA guidelines as illustrated in Figure 1. Initial title/abstract screening of 990 records, based on predefined criteria (relevance to social entrepreneurship, sustainability, AI/DeepTech; peer-reviewed articles/proceedings; English language), excluded 881 irrelevant records. A total of 109 reports were assessed for eligibility using a full-text review based on the inclusion criteria; duplicate records identified during the full-text review were also excluded (n=9), leading to a final sample size of 99 articles for the systematic review and bibliometric analysis (Figure 1).

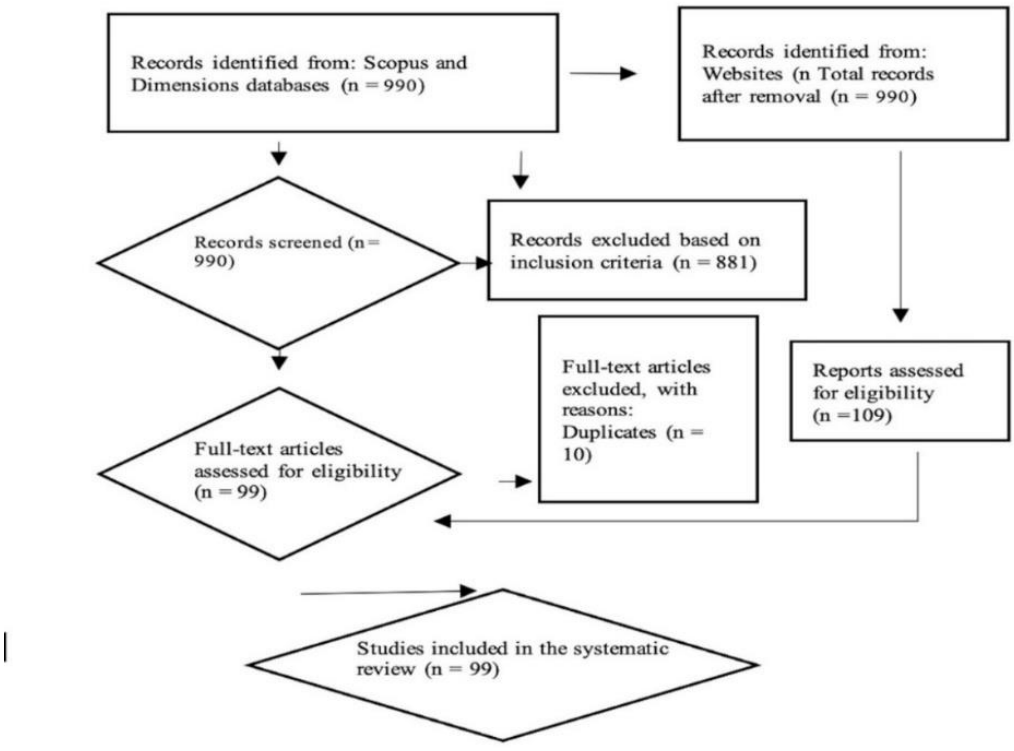
Records identified from: Scopus and Dimensions databases (n = 990)
Records identified from: Websites (n Total records after removal (n = 990)
Records screened (n = 990)
Records excluded based on inclusion criteria (n = 881)
Full-text articles excluded, with reasons: Duplicates (n = 10)
Reports assessed for eligibility (n =109)
Full-text articles assessed for eligibility (n = 99)
Studies included in the systematic review (n = 99)

Figure 1: *PRISMA flow diagram for the systematic review process.*

2.2. Bibliometric analysis

Bibliometric analysis, complementary to the SLR, quantified and mapped the research landscape. R software with the bibliometrix package [8] was used to analyze publication trends, citation metrics, and keyword networks. This package was selected for its comprehensive suite of tools for quantitative literature analysis, including publication trends, citation metrics, and network mapping, aligning with the study's goal of mapping the research landscape. The analysis included descriptive statistics examining annual article counts and citation metrics (Table 1). The Keyword Co-occurrence Network maps thematic connections using network metrics like betweenness centrality, closeness centrality, and PageRank (Figure 3). Furthermore, Word Cloud Visualization represents keyword frequency and prominence visually (Figure 2). This mixed-methods approach ensures a robust and nuanced analysis, combining qualitative synthesis with quantitative bibliometric insights to address the research questions.

3. Results

This section presents the findings from the systematic literature review synthesis and the bibliometric analysis.

3.1. Synthesis of literature findings

Drawing upon the Multi-level Perspective (MLP) theory as a guiding framework, this review synthesizes existing research at the intersection of artificial intelligence (AI), Deep Tech, and social entrepreneurship, with a specific focus on their combined potential as change agents for sustainability transition and regenerative sustainability. This synthesis explores the contributions of AI and Deep Tech to social entrepreneurship, the role of mentoring in this context, the evolving landscape of impact measurement, and strategies for scaling social entrepreneurship towards regenerative outcomes. Given the novelty of this intersection, this synthesis consolidates existing knowledge to build a foundation for understanding the field.

3.1.1. Multi-level Perspective (MLP) theory: a framework for understanding transitions

The Multi-level Perspective (MLP) theory provides a robust framework for analyzing socio-technical transitions towards sustainability [9]. This theory conceptualizes change as occurring across three interacting levels: niches, regimes, and landscapes [10]. Niches are spaces where radical innovations emerge, shielded from the pressures of the dominant system [11,12]. Regimes represent the established socio-technical system, encompassing existing technologies, policies, and practices that often resist change [13]. Landscapes constitute the broader macro-context, encompassing long-term trends like climate change, globalization, and digital transformation [12].

MLP's relevance to sustainability transitions lies in its capacity to analyze how niche innovations can challenge and potentially transform established, unsustainable regimes when landscape shifts create opportunities for disruption [14]. Within this framework, social entrepreneurship, especially leveraging AI and deep tech, can be viewed as a critical force at the niche level, introducing radical innovations designed to disrupt unsustainable regimes [15, 16].

3.1.2. Regenerative sustainability: beyond “less harm” to “more good”

Regenerative sustainability represents a paradigm shift from incremental sustainability approaches, aiming not just to minimize harm but to actively restore and enhance ecological and social systems [17]. It encompasses key principles including ecological health, closed-loop systems, social equity, and evolutionary and adaptive capacity [18]. Social entrepreneurship, powered by AI and deep tech, holds promise in driving these regenerative practices. AI can enable data-driven regenerative agriculture [19], optimize resource usage [20], and foster circular economy business models [21]. Deep-tech innovations contribute through the development of novel sustainable materials [22] and efficient renewable energy solutions [23].

3.1.3. AI and deep-tech contributions to social entrepreneurship and mentoring for sustainability

Emerging literature highlights AI and deep tech as vital enablers for social entrepreneurship to accelerate sustainability transitions [24]. AI's capabilities in data mining and analytics offer significant potential to enhance territorial intelligence and resource allocation for social enterprises, facilitating data-driven decision-making and efficient operations [16]. For instance, AI and big data technologies play a crucial role in building legitimacy and enhancing transparency for social impact enterprises [4]. Kim, et al. [25] propose utilizing AI, particularly agent-based modeling, to analyze complex socio-political factors hindering social innovation, thus paving the way for more effective AI-driven solutions.

DeepTech, characterized by its advanced scientific and engineering base, emerges as a key driver for transformative social entrepreneurship, particularly in addressing complex sustainability challenges. Okuyama [11] illustrates the rapid development and deployment of mRNA vaccines, a DeepTech innovation, as an example of swiftly responding to urgent global problems through technological breakthroughs, applicable to diverse social issues. Several studies further emphasize DeepTech's potential to catalyze new industries and business models around sustainability, particularly within specialized support systems like incubators, highlighting critical success factors and processes for deep-tech ventures [26,27]. These studies point to the need for tailored strategies and ecosystems to nurture deep-tech startups for long-term success in solving complex sustainability challenges [28].

Moreover, the COVID-19 pandemic has catalyzed the rise of digital social entrepreneurship (DSE), highlighting the adaptability and resilience of SE models leveraging digital technologies [2]. Ibáñez et al. [29] explicitly define and examine DSE's role in responding to stakeholder needs during crises, finding digital platforms crucial for enabling collaboration, facilitating social impact even under exogenous shocks and potentially creating new, digitally-driven sustainable development models. Meanwhile, the inherent complexity and novelty of AI and DeepTech-driven social ventures underscore the critical role of mentoring in fostering their effectiveness and success. While dedicated studies on AI-SE mentorship within sustainability are still nascent in the dataset, existing literature on entrepreneurship and the studies themselves point to mentoring's pivotal enabling functions [30]. Consequently, mentoring becomes essential for social entrepreneurs navigating the multifaceted challenges of DeepTech ventures, offering guidance in both technological and business strategy [31]. Effective mentorship programs can address identified skill gaps in deep-tech startups, particularly in areas like strategic foresight, marketing, and market adaptation [32, 33]. Furthermore, mentorship extends beyond technical and business skills, providing vital psychosocial support and fostering leadership competencies like resilience and adaptability, crucial traits highlighted in social entrepreneurship research [34,35].

Access to mentor networks provides social entrepreneurs with valuable connections to investors and industry partners, which is critical for resource-intensive DeepTech ventures, highlighting the importance of ecosystem support and expert guidance provided through mentoring [26]. Moreover, mentorship plays a role in encouraging pro-social behavior in opportunity recognition among social entrepreneurs, channeling their focus towards ventures with genuine social impact and ethical grounding [36].

3.1.4. Impact measurement and metrics for investors

A significant challenge within social entrepreneurship, especially within AI and DeepTech for regenerative sustainability, remains the robust and comprehensive measurement of impact [37]. Current approaches are still evolving, aiming to move beyond traditional financial metrics to capture social and environmental value comprehensively [38]. Researchers are exploring context-specific metrics and typologies of social impact to address the inherent complexities of the field [39]. The drive for improved measurement is further fueled by impact investors who increasingly seek ventures demonstrating measurable social and environmental returns alongside financial sustainability.

Bonfanti et al. [24] emphasize the importance of showcasing blended value and aligning social and environmental impact with business models to attract investors in sustainable ventures. Metrics associated with the Sustainable Development Goals (SDGs), improvements in environmental sustainability, and social equity [40] are gaining significance. This trend indicates a movement toward recognizing the importance of a comprehensive impact that extends beyond mere economic benefits.

3.1.5. Scaling social entrepreneurship for regenerative sustainability

Achieving large-scale sustainability transitions necessitates effective strategies for scaling social entrepreneurship initiatives beyond niche markets. Frameworks like T-shaped Scaling [41] underscore the importance of balancing community grounding (scaling deep) with wider dissemination (scaling wide) for social ventures aiming for large-scale impact. Scaling deep ensures contextual appropriateness and community buy-in [42], while scaling wide facilitates systemic change through replicable models, knowledge sharing, and strategic partnerships [43]. AI and DeepTech technologies can be leveraged as crucial tools for scaling social entrepreneurship, enabling wider outreach, operational efficiencies, and data-driven optimization, accelerating the diffusion of regenerative solutions [44].

3.2. Bibliometric Output

This section presents the quantitative findings from the bibliometric analysis.

3.2.1. Annual scientific production and citations

Table 1 presents a bibliometric analysis of the scholarly output related to regenerative sustainable entrepreneurship research across ten years from 2016 to 2025. The table details the annual scientific production, citation metrics, and citable years for articles published within this domain.

Table 1: *Annual scientific production and citations. It displays the annual values for articles, MeanTCperArt, MeanTCperYear, and CitableYears for each year from 2016 to 2025.*

Year	Articles	MeanTCperArt	N	MeanTCperYear	CitableYears
2016	3	190	3	19	10
2017	3	161.7	3	18	9
2018	2	41	2	5.1	8
2019	3	151	3	21.6	7
2020	12	61.3	12	10.2	6
2021	20	29.3	20	5.9	5
2022	14	15.7	14	3.9	4
2023	25	11.5	25	3.8	3
2024	14	4.9	14	2.4	2
2025	3	0	3	0	1

Source: *Author's compilation from literature using bibliometric analysis of scopus and dimension databases.*

As depicted in Table 1, the number of articles published annually was three in 2016, three in 2017, and two in 2018. Article publication counts then increased significantly, with twelve articles in 2020, twenty in 2021, fourteen in 2022, and twenty-five in 2023. In the subsequent years, fourteen and three articles were published in 2024 and 2025, respectively, indicating a recent surge in research activity in this area. The Mean Total Citations per Article (MeanTCperArt) was 190.0 in 2016 and 161.7 in 2017. This value decreased to 41.0 in 2018, then increased to 151.0 in 2019, followed by a general decline in subsequent years, reaching its lowest point at 0.0 in 2025. The Mean Total Citations per Year (MeanTCperYear) fluctuated, registering 19.0 in 2016, 18.0 in 2017, and 5.1 in 2018. It then increased to 21.6 in 2019, followed by a decrease in later years, reaching 0.0 in 2025.

3.2.2. Mapping key connections: word cloud

Figure 2 presents a word cloud analysis of key terms in sustainable entrepreneurship research, with term sizes proportional to their frequency in the bibliometric analysis. The larger the term, the more frequently it appeared in the keywords of the analyzed publications.

Figure 2: *Word cloud of sustainable entrepreneurship key terms. It represents the relative frequencies of key terms in sustainable entrepreneurship literature.*

Source: *Author's compilation from literature using bibliometric analysis of scopus, web of science, and dimension databases.*

As depicted in Figure 2, social entrepreneurship dominates the research landscape, evidenced by the prominent size of terms such as social entrepreneurship orientation (frequency 14), social entrepreneurship training (frequency 13), and social entrepreneurship research (frequency 8). This indicates a central focus on defining, investigating orientations within, and exploring training methodologies related to social entrepreneurship within this field.

Furthermore, deep tech emerges as a significant element, as represented by deep tech startups (frequency 12) and deep tech satellite (frequency 5), highlighting a notable research emphasis on deep technology's role within entrepreneurial ventures in the context of sustainability. The co-occurrence of sustainable development goals (frequency 7) and sustainable economic growth" (frequency 6) suggests a strong link between social entrepreneurship research and the broader sustainability agenda, with economic growth considered in conjunction with sustainability objectives. Terms like enhanced foresight capabilities and smart circular economy," though less frequent at five instances each, indicate emerging research interests in strategic aspects and innovative models within sustainable social entrepreneurship. In summary, Figure 2 reveals that the core focus of sustainable entrepreneurship research centers on social entrepreneurship and its various facets, increasingly incorporating deep tech innovations and aligning with broader sustainability and economic development goals.

3.2.3. Mapping key connections: co-occurrence network

Figure 3 presents a co-occurrence word network analysis visualizing keyword centrality and clustering within sustainable entrepreneurship literature. Node size and color intensity in the network reflect the term's significance and connections.

Figure 3: *Co-occurrence word network of keyword centrality and clustering. It provides the full details of these co-occurrence network metrics for each keyword node, including their cluster assignments.*

Source: *Author's compilation from literature using bibliometric analysis of Scopus, Web of Science, and Dimension databases.*

As shown in Figure 3, the co-occurrence network analysis identified three distinct clusters of keywords (Clusters 1,2,3). The keyword social entrepreneurship was assigned to Cluster 3 and serves as a central hub, confirming its foundational role in this research domain.

Social entrepreneurship also exhibited the highest betweenness centrality (89) within the network, indicating its significant role in connecting different thematic nodes. Social innovation and social impact both showed a betweenness centrality of 13 and were assigned to Cluster 2 and Cluster 1, respectively, demonstrating their importance as bridging concepts in the literature.

In terms of closeness centrality, social entrepreneurship exhibited the highest value (0.06), which was shared with social innovation and social impact, suggesting these concepts are central to the overall network and can efficiently reach other nodes. Entrepreneurship research, entrepreneurship orientation, sustainable development, developing social, entrepreneurship social, scaling social, and entrepreneurship education each recorded a closeness centrality of 0.03, indicating slightly less direct centrality compared to the core themes.

Social entrepreneurship also displayed the highest PageRank score (0.35), signifying its high influence within the network, likely due to frequent citations and connections. Social innovation and social impact each had a PageRank of 0.06, while entrepreneurship research showed a PageRank of 0.05. Entrepreneurship orientation and scaling social each recorded a PageRank of 0.04, while entrepreneurship education, developing social, and sustainable development each had a PageRank of 0.03. These PageRank scores highlight the relative influence and importance of these keywords within the interconnected research landscape.

4. Discussion

This section interprets the findings from the systematic review and bibliometric analysis, addressing the research questions and discussing implications. The increase in scholarly output shown in Table 1, particularly since 2020, highlights the growing interest in the intersection of social entrepreneurship and sustainability. The observed decline in MeanTCperArt in recent years may reflect the rapid growth of the field, with newer articles having less time to accumulate citations, or potentially indicate a fragmentation of research themes.

This trend warrants further investigation to understand the evolving structure of this research domain, potentially through more granular bibliometric analyses over time. The keyword analyses (Figures 2 and 3) confirm the centrality of social entrepreneurship and highlight key related concepts like deep tech startups, social impact, and sustainable development goals, aligning with the core focus of this review.

4.1. Insights for the circular economy business model framework

The identified trends in scientific output, leading sources, and influential authors effectively highlight a clear pathway for a robust circular economy framework. This framework must fundamentally emphasize compliance with regulations while simultaneously promoting innovation and generating value.

4.1.1. Answering RQ1: ai and deeptech's enhancement of social entrepreneurship for financial innovation

The literature demonstrates that AI and Deep Tech serve as powerful catalysts for social enterprises seeking to revolutionize financial technologies for a sustainable future, directly addressing Research Question 1. Data-driven financial innovation and efficiency serve as an important bolster for attaining sustainable, regenerative social entrepreneurship and can serve as an agent for change towards the transition to a sustainable world, as evidenced by the keyword smart circular economy in Figure 2. As highlighted by Bourekkadi et al. [16] and Figure 2, AI facilitates data-driven financial innovation by enabling social enterprises to develop sophisticated and targeted solutions for sustainable resource allocation and territorial finance. The prominent term sustainable economic growth in Figure 2 further reinforces the focus on AI-driven solutions that integrate economic growth with sustainability objectives in financial markets. Moreover, as Chen & Wang [4] discuss, AI and big data technologies contribute directly to financial institution priorities by enhancing transparency and efficiency in operations, which are critical for building legitimacy and attracting investment.

Furthermore, Figure 2 depicts Deep Tech as a transformative financial instrument as a prominent feature of deep tech startups, indicating a significant scholarly focus on this area. Deep Tech empowers social enterprises to move beyond incremental improvements and develop truly transformative financial instruments for sustainability. For example, within banking and insurance, Deep Tech is facilitating the creation of innovative financial products such as blockchain-based green bonds [45] and AI-driven risk assessment tools for climate-resilient investments [28], enabling the redirection of capital towards regenerative projects and incentivizing sustainable practices in line with financial regulations and evolving market demands (Figure 3, terms like regulation are implicitly present). The growth of DeepTech-focused incubators and venture builders signifies the emergence of specialized ecosystems to support these complex ventures [26,27].

Ultimately, the scalability and reach of digital social entrepreneurship (DSE) in finance, as indicated by keywords associated with social entrepreneurship training and entrepreneurship education in Figures 2 and 3, digital platforms powered by AI and Deep Tech offer unparalleled scalability for social enterprises in the finance sector. Digital Social Entrepreneurship (DSE), accelerated by recent global shifts toward digital economies [2], provides the means to broaden access to innovative and inclusive financial technologies, enhancing stakeholder engagement and enabling the rapid dissemination of sustainable finance solutions [29]. This scalability is particularly crucial for achieving systemic changes in global financial flows needed to effectively finance sustainability transitions and achieve Sustainable Development Goals (SDGs), as highlighted by the prominence of sustainable development goals in Figure 2.

4.2. Answering RQ2: mentoring's role in guiding regenerative finance innovation and impact investment

Addressing Research Question 2, the scholarly output and broader entrepreneurship literature strongly suggest that mentoring is indispensable for navigating the unique complexities of this intersection, particularly in the finance and technology sectors. To navigate complexity and enhance financial acumen, the co-occurrence network in Figure 3 visually highlights the centrality of social entrepreneurship alongside related terms. However, effectively developing regenerative finance solutions using cutting-edge technologies demands a unique and interdisciplinary skillset. Mentoring, as highlighted by the

entrepreneurship training" cluster in Figure 2, provides essential guidance [31,46]. Mentors, especially those with expertise in finance, technology, and social enterprise models, offer invaluable support [32,33].

As highlighted by the presence of enhanced foresight capabilities in Figure 2, developing strategic foresight and investor readiness is another enabler. Mentors play a crucial role in enhancing strategic thinking [32], enabling social entrepreneurs to anticipate evolving financial market trends, adapt to regulatory landscapes, understand the risk profiles of novel financial instruments, and effectively articulate their value propositions to impact investors. Mentoring assists in developing robust financial models and strategies tailored to attract impact investment - a term implicitly reflected in the broader themes of the literature (Figure 3). To facilitate network access, mentors act as key connectors, bridging social entrepreneurs with investors, financial institutions, regulatory bodies, and potential corporate partners [26].

Meanwhile, the potential of AI-driven mentoring in FinTech for good, while not explicitly visualized as a prominent theme in the current keyword analysis (Figures 2 and 3) due to the nascent nature of the field, is a significant area for future development. AI-powered platforms could democratize access to mentorship, for instance, by providing AI chatbots for initial guidance on common startup challenges, using recommendation engines to match entrepreneurs with suitable human mentors or resources, or employing AI tools to analyze business plans, market data, and impact metrics to provide data-driven feedback. These systems could offer tailored guidance and scalable solutions. However, realizing this potential requires careful consideration of the ethical implications and design challenges of AI systems in a coaching context.

4.3. Significance for academia and industry

This review provides a foundational framework for a nascent interdisciplinary field, bridging social entrepreneurship, sustainable finance, and financial technologies. It directs future academic inquiry towards specific research gaps, particularly concerning the development of AI-mentoring models in FinTech for social good and the need for refined impact measurement methodologies within regenerative finance, areas ripe for scholarly contribution. Further bibliometric analysis can explore the evolving keyword landscape over time, revealing granular shifts and emerging sub-themes within this interdisciplinary research area.

For the banking, finance, and insurance sectors, this research underscores the transformative potential of embracing AI-driven social entrepreneurship to drive genuine financial innovation towards sustainability and ecological regeneration. It highlights actionable pathways for developing new, commercially viable, and impact-focused financial products and services, addressing growing investor demand and mitigating climate-related financial risks. The identified crucial role of mentorship emphasizes the strategic importance of establishing corporate mentorship programs, industry-led incubation initiatives, and collaborative ecosystems that can effectively support and accelerate the growth of social enterprises. For impact investors, the review offers a refined understanding of relevant metrics and the value proposition of AI-driven social ventures in finance, providing a framework for more effectively evaluating and deploying capital towards impactful, regenerative financial technologies.

4.4. Directions for future research

Future research should prioritize empirical validation of AI-SE mentorship models through robust quantitative and qualitative studies to establish best practices and assess their effectiveness. This could include pilot programs testing AI-powered mentoring platforms, case studies of social entrepreneurs utilizing AI tools for guidance, or surveys evaluating the perceived value of AI-enhanced mentorship. Alongside this, developing standardized and comprehensive metrics for measuring the complex, systemic impact of regenerative finance innovations is crucial for both academic rigor and attracting mainstream impact investment [37]. Investigating the ethical considerations of AI deployment within social finance, particularly in areas like fairness, bias, and data privacy in AI-driven decision-making and mentoring, is a critical avenue. Exploring policy frameworks that foster responsible innovation and support ecosystems for AI-driven social entrepreneurship in finance is also vital for this burgeoning interdisciplinary field.

4.5. Limitations

This study, while providing a comprehensive review and bibliometric analysis, has several limitations. First, it relies solely on published peer-reviewed academic literature indexed in major databases, which may not capture the full spectrum of innovation and practice occurring in industry or grey literature. Second, the bibliometric analysis is based on keyword co-occurrence and citation patterns, providing a landscape view but not delving into the nuanced content of each article in the same depth as a qualitative synthesis might. Third, the specific intersection of AI-driven mentoring for social entrepreneurship in regenerative finance is a very nascent area, meaning the existing literature directly addressing this specific nexus is limited, which necessarily constrains the depth of findings directly from the review on this particular point. The study identifies the potential and need for this area, but cannot conclude from the extensive existing research found within the defined parameters. Future research, particularly empirical studies, is needed to validate the potential identified in this review and fill the knowledge gaps.

5. Conclusion

This research suggests that AI-driven social entrepreneurship mentoring holds significant potential to be catalytic in driving financial innovation for sustainability transitions and the development of regenerative finance. AI and Deep Tech are powerful enablers, empowering social enterprises to create and scale novel financial solutions for pressing sustainability challenges within the banking, finance, and insurance industries. Mentoring, particularly AI-enhanced approaches, is crucial for effectively guiding social entrepreneurs through the unique complexities of this field and attracting the necessary impact investment. Realizing this vision, however, requires concerted and collaborative efforts across academia, industry, and policy stakeholders to build robust support ecosystems, refine impact measurement frameworks, and prioritize ethical and equitable implementation of AI-driven financial innovation for a regenerative and truly sustainable financial future, aligning with promoting innovation and scholarly research within these crucial sectors.

6. Conflict of Interest

The author declares that there are no known conflicts of interest.

7. Data Availability Statement

In the interest of transparency and reproducibility, the code utilized for the bibliometric analysis (R script) and the anonymized dataset of included articles (extracted bibliographic information, keywords, etc.) will be made available upon publication at the publisher's website as supplementary material. This ensures persistent access and aligns with the journal's policy to facilitate open science.

8. Acknowledgment

The author would like to thank the faculty of Economics and Business staff for their support in the preparation of this manuscript. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

9. Author Contribution

Henry Efe Onomakpo Onomakpo conceived and designed the study, performed the systematic literature review and bibliometric analysis, synthesized the literature findings to build a foundational conceptual understanding and inform future research directions, and drafted the manuscript.

References

1. Miao Q, Liu Z, Shi Y. Social entrepreneurship as a catalyst for sustainability transitions: the China case. Elementa: Science of the Anthropocene. 2022;10:00132.

2. Bacq S, Geoghegan W, Josefy M, et al. The covid-19 virtual idea blitz: marshaling social entrepreneurship to rapidly respond to urgent grand challenges. Bus Horizons. 2020;63:705-23.

3. Al-Omoush K, Ribeiro-Navarrete B, McDowell WC. The impact of digital corporate social responsibility on social entrepreneurship and organizational resilience. Manag Decis. 2023;62:2621-40.

4. Chen J, Wang Z. How do artificial intelligence (ai) and big data (bd) technologies help social impact enterprises build legitimacy? J Glob Inf Manag. 2024;32:1–21.

5. Li B. Effects of digital economy on social entrepreneurship: evidence from China. Manag Decis Econ. 2023;44:4248-61.

6. Åstebro T, Hoos F. Impact measurement based on repeated randomized control trials: the case of a training program to encourage social entrepreneurship. Strateg Entrep J. 2021;15:254-78.

7. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. PLOS Medicine. 2021;18:e1003583.

8. Aria M, Cuccurullo C. Bibliometrix: an R-tool for comprehensive science mapping analysis. J Informetr. 2017;11:959-75.

9. Geels FW. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case study. Res Policy. 2002;31:1257-74.

10. Geels FW, Schot J. Typology of sociotechnical transition pathways. Res Policy. 2007;36:399-417.

11. Okuyama R. Nurturing deep tech to solve social problems: learning from covid-19 mRNA vaccine development. Pathogens. 2022;11:1469.

12. Geels FW. The multi-level perspective on sustainability transitions: responses to critique. Environ Innov Soc Trans. 2011;1:20-40.

13. Rip A, Kemp R. Technological change and the environment. In: Grin J, van de Heuvel B, Verbong C, editors. Dynamics of innovation in the Dutch energy system. Amsterdam: Het Spinhuis; 1998. pp.19-46.

14. Upham P, Eberhardt L, Klapper RG. Rethinking the meaning of "landscape shocks in energy transitions: german social representations of the fukushima nuclear accident. Energy Res Soc Sci. 2020;69:101710.

15. Chandra Y, Jiang LC, Wang CJ. Mining social entrepreneurship strategies using topic modeling. PLOS ONE. 2016;11:e0151342.

16. Bourekkadi S, Kerkeb ML, El Imrani O, et al. The use of data mining to influence social entrepreneurship and territorial dynamics. E3S Web of Conferences. 2023;412:01104.

17. Du-Plessis C, Cole RJ. Motivating change: shifting the paradigm. Build Res Inf. 2011;39:436-49.

18. Mylan J, Andrews J, Maye D. The big business of sustainable food production and consumption: exploring the transition to alternative proteins. Proc Natl Acad Sci. 2023;120:e2207782120.

19. Nguyen NTH, Kowalski AM, Dzienis AM. Sustainable entrepreneurial process in the deep-tech industry. Sustainability. 2024;16:8714.

20. Maftah J, Pheniqi Y, Bourkkadi S. The use of data mining to influence social entrepreneurship and territorial dynamics. E3S Web of Conferences. 2023;412:01104.

21. Trevisan AH, Lobo A, Guzzo D, et al. Barriers to employing digital technologies for a circular economy: A multi-level perspective. J Environ Manag. 2023;332:117437.

22. Dzhengiz T, Haukkala T, Sahimaa O. Sustainable transitions towards fast and ultra-fast fashion. Fash Text. 2023;10:19.

23. Babonneau F, Badran A, Haurie A, et al. GCC countries strategic options in a global transition to zero-net emissions. Environ Model Assess. 2023;28:709-33.

24. Bonfanti A, De Crescenzo V, Simeoni F, et al. Convergences and divergences in sustainable entrepreneurship and social entrepreneurship research: a systematic review and research agenda. J Bus Res. 2024;170:114336.

25. Kim E, Jang GY, Kim SH. How to apply artificial intelligence for social innovations. Appl Artif Intell. 2022;36:2031819.

26. Meyer D, Colonna F, Meyer R. Success factors of deep tech incubators: a qualitative study. European Conference on Innovation and Entrepreneurship. 2024;19:507-14.

27. Romme AGL, Bell J, Frericks G. Designing a deep-tech venture builder to address grand challenges and overcome the valley of death. J Organization Design. 2023;12:217-37.

28. Olan F, Papadopoulos T, Spanaki K, et al. Social entrepreneurial marketing and innovation in b2b services: building resilience with explainable artificial intelligence. Inf Syst Front. 2025.

29. Ibáñez MJ, Guerrero M, Yáñez-Valdés C, et al. Digital social entrepreneurship: the N-Helix response to stakeholders' COVID-19 needs. J Technol Transf. 2021;47:556-79.

30. García-González A, Ramírez-Montoya MS. Social entrepreneurship education: changemaker training at the university. Higher Education Skills and Work-based Learning. 2021;11:1236-51.

31. Batool SN, Thiel J. Lean startup-based business coaching and the acceleration of deep tech ventures. Acad Manag Proc. 2023;2023:1.

32. Capatina A, Bleoju G, Kalisz D. Falling in love with strategic foresight, not only with technology: european deep-tech startups' roadmap to success. J Innov Knowl. 2024;9:100515.

33. Schutselaars J, Romme AGL, Bell J, et al. Designing and testing a tool that connects the value proposition of deep-tech ventures to SDGs. Designs. 2023;7:50.

34. Chinchilla A, Garcia M. Social entrepreneurship intention: mindfulness towards a duality of objectives. Hum Manag J. 2017;1:205-14.

35. Stirzaker R, Galloway L, Muhonen J, et al. The drivers of social entrepreneurship: agency, context, compassion and opportunism. Int J Entrepren Behav Res. 2021;27:1381-402.

36. Yitshaki R, Kropp F, Honig B. The role of compassion in shaping social entrepreneurs' prosocial opportunity recognition. J Bus Ethics. 2021;179:617-47.

37. Rawhouser H, Cummings M, Newbert SL. Social impact measurement: current approaches and future directions for social entrepreneurship research. Entrep Theory Pract. 2019;43:82-115.

38. Bradač-Hojnik B, Crnogaj K. Social impact, innovations, and market activity of social enterprises: comparison of European countries. Sustainability. 2020;12:1915.

39. Narangajavana Y, Gonzalez-Cruz T, Garrigos-Simon FJ, et al. Measuring social entrepreneurship and social value with leakage. Definition, analysis and policies for the hospitality industry. Int Entrep Manag J. 2016;12:911-34.

40. Ramya J, Sharma A, Siddiqui S, et al. Social entrepreneurship and sustainable development goals: aligning business with social objectives. Educ Admin Theory Pract. 2024;30:944-52.

41. Nardini G, Bublitz MG, Butler C, et al. Scaling social impact: marketing to grow nonprofit solutions. J Public Policy Mark. 2022;41:254-76.

42. Hidayat D, Putra A. Participative based social entrepreneurship training for community empowerment. Digit Press Soc Sci Humanit. 2020;6:00016.

43. Otokiti BO, Igwe AN, Ewim CPM, et al. A framework for scaling social entrepreneurship in nigeria: strategies for creating sustainable social impact. Int J Manag Organ Res. 2024;3:103-20.

44. Chen Y, Albert LJ, Jensen S. Innovation farm: teaching artificial intelligence through gamified social entrepreneurship in an introductory MIS course. Decis Sci J Innov Educ. 2021;20:43-56.

45. Baucherel K. Blockchain from Hype to Help. ITNOW. 2018;60:4-7.

46. Kask J, Linton G. Editorial: five principles for overcoming obstacles in deep-tech startup journeys. J Small Bus Enterp Dev. 2023;30:1-3.